

SECTION 412200
HOISTS AND CRANES

PART 1 – GENERAL

101. GENERAL

101.1 Intended Use of the Specified Equipment

- a. The plant will utilize the auxiliary cranes and hoists for lifting and handling components, equipment and material as required to service equipment that may require maintenance. The equipment shall be capable of operation under remote or manual control as specified.
- b. DISTRICT is relying upon CONTRACTOR's ability, experience, expertise, judgment and skill to furnish equipment that is suitable and fit for such purposes and uses.

101.2 Scope of Work

- a. CONTRACTOR shall design, manufacture, test, furnish, deliver and install the cranes and hoists as specified below, complete with integral components including hoisting equipment, trolleys and jibs and as otherwise specified in accordance with applicable national codes and standards.
- b. The work shall include all necessary and/or usually supplied equipment and appurtenances for the safe, efficient and convenient operation of the cranes and hoists whether or not such items are specifically referred to. The work shall include start-up, spare parts and special tools required for erection and maintenance.
- c. Electric trolleys and electric hoists shall be provided for critical equipment and motors exceeding a weight of 2 tons. Critical equipment is defined as any piece that does not have a 100% redundant unit installed.
- d. For indoor machines or equipment, where the weight of a single part to be handled is 1 ton to 10 tons, a minimum of a monorail (furnished under Section 051223) with trolley shall be provided.
- e. Where the weight of a single part to be handled is less than 1 ton, only an overhead steel beam (furnished under Section 051223) for fastening the hoisting tool shall be provided.
- f. For outdoor machines or equipment, where removal using mobile crane or other mobile devices is practical, hoists or other lifting devices as described below need not be provided, if the alternate removal and maintenance plan is approved by the DISTRICT.
- g. For outdoor machines or equipment, where the weight of a single part to be handled is 1 ton to 10 tons, a minimum of a fixed hoist shall be provided.
- h. Where the weight of a single part to be handled is less than 1 ton, only an overhead beam or lifting lug for fastening the hoisting tool shall be provided.
- i. The hoisting facilities with hoisting capacity over 10 tons or lifting height over 25 feet shall be motor operated regardless of frequency of use.
- j. The lifting access bay(s) in the boiler building servicing the boiler building floors shall be provided with a 5 ton electric operated radio controlled tugger with motor operated trolley.

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- k. Rail sweeps, motors, motor starters, gears, brakes, wheels, stops, bumpers, handrails, cables, wiring, panels, lighting, conductors, power feed connectors, festooning, pendant controls, hoists, hooks, ropes, limit switches, etc. shall be provided as needed for the application, performance and operating characteristics specified.
- l. Electric motors shall be rated at 460 VAC, 3-phase, 60 Hz, used on a 480 VAC system.
- m. CONTRACTOR shall be responsible for the proper operation of each complete unit assembly as indicated by the factory performance tests and field acceptance tests in accordance with Crane Manufacturers Association of America (CMAA), latest issue.
- n. CONTRACTOR shall provide all the necessary auxiliaries and features including, but not limited to, the following:
 - n1. All interconnecting piping, tubing, fittings, supports, wiring, controls and hardware integral to or between any equipment furnished.
 - n2. Initial fill of any required lubricating oil and hydraulic oil.
 - n3. Detailed design of inserts, anchor bolts, leveling wedges, washer spacers and sub-plates required for mounting the crane or hoist.
 - n4. Representative to witness testing.
 - n5. Shop painting with primer and finish coat of all appropriate items.
 - n6. All necessary instrument, power and control wiring and conduit local to any equipment furnished.
 - n7. Where CONTRACTOR-supplied lifting equipment attaches to DISTRICT's support structure, CONTRACTOR shall separately list forces, moments and any other reactions transmitted by the CONTRACTOR's equipment to the support structure, including weight, operating, dynamic, seismic and thermal loads. CONTRACTOR shall provide all the requisite details for DISTRICT's support structure design.
 - n8. Shop testing including functional testing of equipment
- 101.3 Work by Others
 - a. Electric power feed to the main power junction boxes for the electric powered jib cranes, hoists and trolleys.
- 101.4 Terminal Points

CONTRACTOR's work shall be completely pre-fabricated such that the only field installation required by DISTRICT is at the following interfaces:

 - a. There will be one (1) power supply terminal point for each electric powered hoist and trolley set and for each electric powered jib crane. The terminal point for each power supply (480 VAC, 3 phases, 60 Hz) to its respective crane is the terminal box, furnished by the CONTRACTOR. This terminal point will be located near the electric powered application. The DISTRICT will connect his power cable to the CONTRACTOR's terminal box. Voltages for control, lighting and maintenance of less than 480 VAC shall be furnished by the CONTRACTOR.
 - b. DISTRICT's Grounding System Cable.

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102. CODE REQUIREMENTS

102.1 Publications of the following nationally recognized organizations and others listed are applicable to the design, manufacture and testing of the equipment included to the extent specified therein. All references to publications are to the latest issue of each together with all latest addenda, amendments or additions thereto as of the date of Contract. References within this specification will be made in accordance with the abbreviations listed below:

AISC	American Institute of Steel Construction	
AISE	Association of Iron and Steel Engineers	
	AISE Standard No. 4	Alloy Steel Chain and Alloy Steel Chain Slings for Overhead Lifting
ASME/ ANSI	American Society of Mechanical Engineers	
	ASME B30.10	Hooks
	ASME B30.16	Overhead Hoists (Underhung)
AWS	American Welding Society	
	AWS D1.1	Structural Welding Code
	AWS D14.1	Specification for Welding Industrial and Mill Cranes
CMAA	Crane Manufacturers Association of America, Inc.	
HMI	Hoist Manufacturer Institute	
	HMI Hoist Class H1 Code	
IBC	International Building Code	
	IBC 2006	2006 Edition of International Building Code
ICEA	Insulated Cable Engineers Association	
NEMA	National Electrical Manufacturers Association	
	Pub. No. ICS-1 through ICS-6	Industrial Controls and Systems
	Pub. No. MGI	Motors and Generators
NFPA	National Fire Protection Association	
	NFPA 70	National Electrical Code
SSPC	The Society for Protective Coatings	
	System Book	Systems and Specifications Steel Structures Painting Manual Volume 2

102.2 Electrical equipment shall be in accordance with standards of National Electrical Code as well as local and state ordinances.

PART 2 – PRODUCTS

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201. TECHNICAL REQUIREMENTS

201.1 General Design and Construction

- a. The condition of hoisting facilities shall be consistent with the Hoist Manufacturer Institution (HMI) Hoist Class H1 Code.
- b. Equipment shall be suitable for operation based on the location where installed and associated ambient conditions as specified in Section 011900.
- c. Hoisting facilities shall be designed to be able to hoist both mechanical equipment and motors.
- d. All hoists, trolleys, etc. shall be load rated.
- e. The load-rated capacity of all hoists, trolleys, etc. shall be clearly stenciled on each device and shall be clearly visible from the operating floor.
- e1. Motor operated cranes and hoists shall be equipped with a pendant push button control box facing the working direction.
- e2. Controls shall include "dead man" feature.
- f. Chain wheels, if provided for chain operation, shall be equipped with a guide to prevent the chain from "gagging" or leaving the wheel pocket.

201.2 Hoisting Ropes

- a. The hoisting ropes shall be fabricated from Improved Plow Steel and the design and construction shall be 6 x 37class which is commercially identified as "Special Flexible Hoisting Rope" or "Crane Rope".
- b. The hoisting ropes shall be of the preformed construction, wherein the individual wires in the strands and the strands in the rope are preformed or pre-shaped to their proper shape before they are assembled in the finished rope.
- c. Non-spinning cable shall be used on all hoists where the load is suspended by a single line.
- d. Rope drums shall be fabricated steel, not cast iron, and shall be machined for the rope used. Each drum shall take the full length of the hoisting rope without over winding. Hoisting drums shall be provided with machined grooves to leave at least two wraps of rope in the groove when the hook is in the lowest position.

201.3 Hooks

Each hook shall be of forged steel supported on a ball or roller bearing. They shall rotate freely with this bearing.

201.4 Gearing

- a. All gears shall be forged, rolled or welded steel with cut teeth and shall be of the spur, helical or herringbone type. All gearing shall be enclosed in dust-tight housing.
- b. All high-speed gearing shall operate in an oil bath and slow speed gearing in grease.
- c. Gearing shall be designed to Class C.

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201.5 Bearings

All bearings, except those subject to a small amount of movement shall be of the antifriction type with the balls or rollers retained in a cage.

- a. Bearings which are associated with enclosed gears that either run in oil or are splash lubricated shall also be oil bath lubricated. Other bearings such as axle bearings, cross-shaft bearings and sheave bearings shall be packed with grease and lubricated through pressure-type fittings. Bearing enclosures shall be designed to exclude dirt and prevent leakage of oil or grease.
- b. Antifriction bearings shall be selected to give a minimum B-10 life of 5000 hours (based on vacuum-degassed steel rating) based on fuel-rated speed.

201.6 Lubrication

- a. Lubricating devices shall be provided for all bearings and journals. Bearing housings shall be oil-and/or grease-tight. The equipment shall be arranged so that all points of lubrication are easily and safely accessible.
- b. Lubrication points and gearbox drains shall be piped to minimize lube points and provide accessible locations.
- c. CONTRACTOR shall furnish a sufficient quantity of all lubricants required for the equipment furnished by CONTRACTOR for initial operation of equipment.

201.7 Guards

- a. Shields or enclosures shall be provided over any part of the equipment that needs protection from water and dust. All slip rings, limit switches and other contact-making devices shall be well protected.
- b. Exposed moving parts such as gears, flexible couplings, projecting keys, set screws, etc. that might constitute a hazard under normal operating conditions and as required by safety codes and regulations of public authorities that apply shall be equipped with substantial guards. Guards shall be securely fastened.

201.8 Limit Switches

- a. Motor driven hoists shall be provided with automatic limit switches to operate when the hook reaches the highest or lowest safe position and when the trolley (where applicable) reaches its design limit of travel.
- b. The hoist limit switch shall be arranged to allow the hook to be lowered after being stopped at the high limit and to be raised after being stopped at the low limit. Similarly, the trolley limit switch shall allow trolley movement in the reverse direction after being stopped at its travel limit.

201.9 Trolley Acceleration Control

- a. Smooth trolley acceleration shall be provided to decrease the pendulum swing of the load.
- b. The control system shall be capable of starting, stopping, reversing, jogging, or plugging under any load at any speed without causing excessive pendulum swing of the load.

201.10 Brakes

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Electric-operated equipment shall be provided with brakes to retard or stop and hold the motion of the trolley and hoist. Brakes shall be suitably mounted for convenient and rapid operation. Descriptions of the specific features to be provided, according to the category of brake, are as follows:

- a. Electric Brakes
 - a1. Shoe-Type: Shall be either an ac solenoid-released, spring-set brake designed per AISE standards or a dc magnet-released spring-set brake, designed per AISE-NEMA standards. Each brake shall be heavy-duty type and self-adjusting.
 - a2. Disc Type: Shall be either ac solenoid- or dc magnet-released, spring-set, totally enclosed multiple discs with stationary releasing magnets to eliminate the need for flexing wire leads.
- b. Electric/Hydraulic Brakes

Shoe-Type: Shall serve as a dc magnet or ac solenoid electrically released spring-set parking brake and a hydraulically applied service brake, heavy duty, self adjusting designed to meet AISE-NEMA standards. The hydraulic actuating cylinder shall be located so that there is no possibility of hydraulic fluid dripping on brake wheels or lining.
- c. Hydraulic Brakes

Shoe-Type: Shall be heavy-duty, self-adjusting, spring-released, hydraulically applied designed to respond to direct hydraulic operation. Brake shall be equipped with an automatic bleeder system operated by a pushbutton. The hydraulic actuating cylinder shall be located so that there is no possibility of hydraulic fluid dripping on brake wheel or linings.
- d. Hoist Motion Brake: pendant control
- e. Hoist Motion Control Brake: To control the speed during lowering.
- f. Trolley Motion Brakes: The brake for the trolley motion may be either the electric shoe-type or the electric disc-type.

202. ELECTRICAL EQUIPMENT REQUIREMENTS

202.1 General Requirements

- a. Motor operated equipment shall come complete with all motor starters, control power transformers, power, and control and instrument wiring. Electrical power interface shall be at one point for each crane as noted in Article 101.4.a.
- b. For motor-operated equipment, internal hoist wiring shall be installed in the shop and controls shall be shop wired. All parts and subassemblies requiring field assembly shall be piece marked and match marked.
- c. CONTRACTOR shall provide weatherproof enclosures suitable for washdown via direct hose for limit switches, controls, brakes, motors and other electrical and controlling components

202.2 Control Power:

- a. Electrical voltage for control shall be a nominal 120 volt, single-phase grounded, 60 Hz, alternating current. CONTRACTOR shall provide all devices required for proper operation and protection of his

equipment during electrical power supply and ambient temperature fluctuations described in the following paragraphs.

- b. All ac electrical control devices shall, unless otherwise specified, shall be designed to operate satisfactorily with variations of ± 10 percent in the supply voltage of 120 volts and ± 5 percent frequency variation alternating current. The dropout voltage shall be less than 75 percent for relays and 85 percent for contactors and starters. Alternating current electrical control devices operating at nominal voltages other than 120 volts shall be designed for continuous operation over proportional voltage variations.
- c. All devices shall be guaranteed to operate satisfactorily under voltage conditions specified in the above paragraphs and an ambient temperature of 40°C. The ambient temperature for the boiler building is 50°C.

203. STRUCTURAL REQUIREMENTS

203.1 Loading Considered

Loadings for structural design of hoists and jib cranes are derived from:

- a. General – Per the IBC-2006 Code. New power plant buildings, structures and equipment directly related to power generation are classified as Category II per Table 1604.5 of IBC-2003.
- b. Wind – as required by Section 011900.
- c. Live load and dead load per this specification.
- d. Live load and dead load per AISE and CMAA.
- e. Other – as required to complete the Work.

203.2 Load Combinations

Load combinations are to be in accordance with AISC and the IBC-2006 Code or as required to complete the work.

203.3 Design and Engineering

Design and engineering approaches and techniques shall use good engineering practice. Analysis and design shall include all possible physical conditions that could affect the structural serviceability, stability and stresses.

204. CLEANING AND PAINTING

Cleaning and painting shall be per manufacturer's standard procedure.

PART 3 – EXECUTION

301. INSPECTION AND TESTING

301.1 Inspections:

- a. The DISTRICT shall have the right to inspect all equipment covered by this Specification and to witness any tests made on the equipment. The CONTRACTOR shall furnish the DISTRICT with 14

- days advance notification of final assembly and testing and provide drawings documents, mill certificates, Material Safety Data Sheets and a certificate of compliance.
- b. Shop Inspection Test Plan (ITP) shall be obtained and submitted from all sub-suppliers.
- 301.2 Field Tests:
- After completion of erection, the Auxiliary Cranes and Hoists shall be field tested by the DISTRICT.
- 301.3 Performance and Reliability Tests:
- a. After the cranes and hoists are placed into service, DISTRICT will perform load and range of motion tests to ascertain that the complete equipment is performing according to the guarantees in every respect. CONTRACTOR shall arrange to have an authorized representative present to witness and assist in the tests. Tests will be in accordance with the Crane Manufacturers Association of America insofar as it is applicable and practical for the installation.
- b. CONTRACTOR shall furnish a test procedure for testing the equipment in accordance with the codes and acceptance test criteria. The test procedure shall clearly spell out any equipment necessary for the tests and where it must be located to obtain the necessary data.

END OF SECTION 412200

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